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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/563,105

12/30/2005

Misao Takakusaki

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EXAMINER

SONG, MATTHEW J

ART UNIT

PAPER NUMBER

1792

NOTIFICATION DATE

DELIVERY MODE

06/12/2009

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com

Office Action Summary	Application No. 10/563,105	Applicant(s) TAKAKUSAKI ET AL.	
	Examiner MATTHEW J. SONG	Art Unit 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 March 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 2/2/2009 has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1-6 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 1 recites, "the remaining molecular beam intensity of the first group V element is not less than 1/100 of that in the first step" in lines 9-10. There is no support for the claimed range in the original disclosure. Applicant alleges support for the amendment in Figure 4. Figure 4 merely shows the As molecular beam intensity as a function of time and does not support the claimed range of not less than 1/100. The corresponding part of the specification regarding

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Figure 4 merely teaches the beam is reduced to about 1/14 within about 1 second, and to 1/50 or less within about 10 seconds (pg 9-10); therefore does not provide support for the claimed range.

The same arguments apply to claims 2-5 which depend from or include the same limitation.

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claim 1-6 recites the limitation "the remaining molecular beam intensity" in line 8.

There is insufficient antecedent basis for this limitation in the claim. The same argument applies to claim 2 and claims 3-6 which depend from the independent claims.

6. Claims 1-6 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 1 recites, "the remaining molecular beam intensity of the first group V element is reduced to 1/10 or less of that in the first step, wherein the remaining molecular beam intensity of the first group V element is not less than 1/100 of that in the first step" in lines 7-10. The claim is indefinite because the claim recites two different ranges for the remaining beam intensity. The examiner suggests coupling the ranges together, such as wherein the beam intensity is 1/10 or less **and** not less than 1/100. The same arguments apply to the remaining claims which incorporate the same limitation.

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7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 1-3 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kashima et al (JP 07-086162), an English Abstract and Computer Translation (CT) are provided, in view of Saito (JP 64-073715), an English Abstract is provided.

Kashima et al discloses a method of forming a heterostructure film comprising supplying a group IIIa and Va material to grow an IIIaVa thin film using gas source molecular beam epitaxy (Abstract, Fig 1, and CT [0005]-[0007]), this reads on a applicant's first step of irradiating a molecular beam of at least one group III element and a molecular beam of a first group V element to form a first compound semiconductor layer. Kashima et al also discloses supply to a substrate of a Va group material is suspended and t2 time discontinuation of the supply of all thin film raw materials to a substrate is carried out to terminate growth of the IIIaVa

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thin film (Abstract, Fig 1 and CT [0005]), this clearly suggests a second step of stopping the irradiation of the molecular beam of the group III element and the molecular beam of the first group V element and halting growth until an amount of the first group V element supplied is reduced to 1/10 or less of that in the first step because Kashima et al teaches a time period t_2 where all raw materials are suspended which suggests reducing a supply of the first group V element to 0 and because Kashima et al teaches closing the shutter to the molecular source beam which would result in 0 irradiation from the source cell (CT [0002]). Kashima et al also teaches supplying a Vb and IIIb material to grow a IIIbVb thin film after the time period t_2 . (Abstract and [0005]). Kashima et al also teaches forming a heterostructure of InGaAs and InP (CT [0007] and Fig 2, 4 and 5), this reads on applicant's etch stopper layer on the first compound semiconductor layer where the etch stopper being composed of the second compound semiconductor layer which is different from the first compound semiconductor layer because Kashima et al teaches the same materials as applicant for the etch stopper layer (See instant claim 3).

Kashima et al does not explicitly teach halting growth for a period of time until the remaining molecular beam intensity of the first group V element is reduced to 1/10 or less and not less than 1/100 of that in the first step. Kashima et al does teach by adjusting supply downtime t_2 , deposition of superfluous group Va element in a heterointerface is controlled and it is very steep (CT [0006]). Kashima et al also teaches a downtime was carried out for 24 seconds, which would be expected to reduce the remaining beam intensity to less than 1/10 because applicant teaches stopping for 1 second reduced As beam intensity to about 1/14 (pg 9 of the specification).

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In a method of molecular beam crystal growth, note entire reference, Saito teaches the surface layer is flatten by forcibly exhausting hydrogen gas and Group V elements (Abstract). Saito teaches after the growth process of depositing GaAs, residual molecules are forcibly exhausted by a turbo-molecular pump (abstract).

Therefore, It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Kashima et al by forcibly exhausting remaining group V elements after growth of the first layer, as taught by Saito, to flatten the layer and because to remove superfluous group V elements from the heterointerface to produce a steep heterointerface.

As to the claimed range of not less than 1/100, the combination of Kashima et al and Saito clearly suggest removing all of the group V residual molecules to produce a steep heterointerface. Applicant also teaches the epitaxial growth is temporarily stopped according to the attenuation of the intensity of the As molecular beam and it is therefore possible to prevent the group V element, which is unnecessary in the InP layer, from being mixed into the InP layer and thus form a sharp heterointerface. A prima facie case of obviousness exists when the claimed range and the prior art range do not overlap but are close enough such that one skilled in the art would have expected them to produce products having the same properties. *Titanium metal Corp. Am v Banner*, 778 F.2d 775, 783, 227 USPQ 773, 779 (Fed. Cir. 1985). Therefore, the same effect would be expected for 1/100 or more and halting growth for 24 seconds, as taught by the combination of Kashima and Saito, to remove superfluous group V molecules to produce a steep heterointerface. Furthermore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Kashima and Saito by optimizing the delay to time to produce a steep heterointerface.

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Referring to claim 2, the combination of Kashima and Saito teaches the first step, the second step and the third step, as discussed previously.

Referring to claims 3 and 5, the combination of Kashima and Saito teaches a first compound semiconductor of InGaAs and a second layer of InP. (CT [0007] and Fig 4-5).

9. Claims 4 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kashima et al (JP 07-086162), an English Abstract and Computer Translation (CT) are provided, as applied to claims 1-3 and 5 above, and further in view of Watanabe (US 6,229,162).

The combination of Kashima and Saito teaches all of the limitations of claim 4, as discussed previously, except a first layer of InP or InGaP and a second layer of InAlAs or InGaAs. Kashima et al does teach forming a heterostructure with a first layer of InGaAs and a second layer of InP, thus the order of the first and second layer is the feature which is not explicitly taught.

In a method of forming a semiconductor device, note entire reference, Watanabe teaches forming a photodiode comprising an InP etching stop layer **16**, an InAlAs cap layer **17**, an InGaAs second etching stop layer **18**, an InP etching stop layer **19**, an InAlAs cap layer and a InGaAs contact layer **111** grown using gas source molecular beam epitaxy. (Abstract, col 8, ln 35-50 and Fig 1).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Kashima and Saito by using a first layer of a InP **16** and a second layer of InAlAs **17** or InGaAs **18** as a second layer, as taught by Watanabe to produce a useful device.

Response to Arguments

10. Applicant's arguments with respect to claims 1-6 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW J. SONG whose telephone number is (571)272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Kornakov can be reached on 571-272-1303. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Matthew J Song
Examiner
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MJS

June 4, 2009

/Robert M Kunemund/

Primary Examiner, Art Unit 1792